

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-261517
(43)Date of publication of application : 11.10.1996

(51)Int.Cl. F24F 5/00
F25B 1/00
F25B 13/00

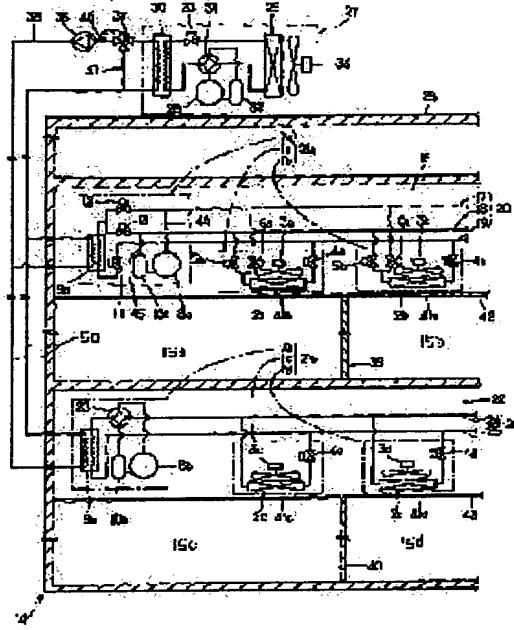
(21)Application number : 08-074733 (71)Applicant : SANYO ELECTRIC CO LTD
(22)Date of filing : 28.03.1996 (72)Inventor : SEKIGAMI KUNIMORI

(54) AIR-CONDITIONING DEVICE

(57)Abstract:

PURPOSE: To provide a heat recovery type air-conditioning device for a building suitable for an indoor load.

CONSTITUTION: A heat source machine 27 to produce heat source water is arranged on a roof 35 of a building 14. Refrigerating machines 21a and 21b comprise units 7a and 7b on the heat side connected together through a heat source machine 27 and a water piping 50; and a plurality of units 1a, 1b, 1c and 1d on the utilizing side connected to a refrigerant piping 20 extended from the heat units on the heat source side are arranged in each floor of the building. The units 7a and 7b on the heat source side incorporate compressors 8a and 8b and water heat exchangers 9a and 9b to make a refrigerant exchange heat with heat source water. A refrigerant piping 20 connected to the two apparatuses and extended from a unit on the heat side comprises a high pressure gas pipe 17, a low pressure gas pipe 18, and a liquid pipe 19.



LEGAL STATUS

[Date of request for examination] 28.03.1996

[Date of sending the examiner's decision of rejection] 12.05.1998

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] In the conditioner which has arranged the heat source which generates heat source water on the roof of a building, and has arranged the refrigerator which becomes each story of this building from the use side [two or more sets] unit connected with the heat-source side unit list connected for said heat source and water piping with refrigerant piping prolonged from this heat-source side unit. The conditioner characterized by constituting refrigerant piping which is made to build the hydrothermal exchanger to which heat exchange of the refrigerant is carried out with a compressor and said heat source water in said heat-source side unit, and is connected with both [these] devices, and is prolonged from said heat-source side unit from high pressure gas tubing, a low voltage gas pipe, and a liquid tube.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the conditioner which carries out the air conditioning of each story of a skyscraper.

[0002]

[Description of the Prior Art] the heat-source side unit which built in the one apparatus conditioner with which a compressor, a heat-source side heat exchanger, and a use side heat exchanger are built in one, and are installed in each story as it considers as the conditioner which carries out the air conditioning of the skyscraper etc., for example, is shown by JP,52-7082,Y, and a compressor and a heat-source side heat exchanger -- the roof of a building -- and there is a discrete-type conditioner which installed the use side unit which built in the use side heat exchanger in the room of each story.

[0003]

[Problem(s) to be Solved by the Invention] In the one apparatus air conditioning system of presentation with the above-mentioned official report, in order for some air conditioning systems to be exposed from each story of a building, while appearance was bad, when there was nothing in **** about a sound isolation means so that the noise of a compressor might not leak out to each air conditioning systems of all, it did not become. Moreover, in the above-mentioned discrete-type conditioner, while cooling capacity was not enough demonstrated by the piping length between the difference of elevation of a heat-source side unit and a use side unit, or both this unit, the oil return from a use side unit to a heat-source side unit was bad at the time of air conditioning, and a possibility that a compressor might be damaged was in it.

[0004] While this invention solves this technical problem, one side is air-conditioned in each story (floor) of a skyscraper, and it aims at offering the conditioner for the buildings of the heat recovery mold which fitted the indoor load like heating in another side.

[0005]

[Means for Solving the Problem] In order to attain this purpose, this invention arranges the heat source which generates heat source water on the roof of a building. The refrigerator which becomes each story of this building from the use side [two or more sets] unit connected with the heat-source side unit list connected for said heat source and water piping with refrigerant piping prolonged from this heat-source side unit is arranged. Refrigerant piping which is made to build the hydrothermal exchanger to which heat exchange of the refrigerant is carried out with a compressor and heat source water in this heat-source side unit, and is connected with both [these] devices, and is prolonged from a heat-source side unit consists of high pressure gas tubing, a low voltage gas pipe, and a liquid tube.

[0006] Thus, since it constituted, when performing air conditioning parallel running within the refrigerator which consists of between the use side units connected to the heat-source side [one] unit (i.e., these units), exhaust heat recovery is performed through a refrigerant. On the other hand, when performing heating-and-cooling parallel running between different refrigerators, exhaust heat recovery is performed through heat source water.

[0007]

[Embodiment of the Invention] The use side [two or more sets] unit in which 1a and 1b built use side heat exchanger 2a, 2b, Blowers 3a and 3b, the main reducing valves 4a and 4b, such as an electric expansion valve, and change-over valves 5a, 6a, 5b, and 6b, respectively when explained based on drawing 1 , 7a is the heat-source side unit which built in capacity good transformation compressor 8a, hydrothermal exchanger 9a of a water cooling type, vapor-liquid-separation machine 10a and the auxiliary reducing valves 11, such as an electric expansion valve, with which adjustable [of the operation frequency] is carried out, and change-over valves 12 and 13. Heat-source side unit 7a and the use side units 1a and 1b are installed in the head-lining space 16 of Building (building) 15a and 14 15b, for example, the rooms of the second floor. Heat pump type refrigerator 21a is constituted like illustration by connecting for the refrigerant piping 20 between [of three] units which consists of the high pressure gas tubing 17, a low voltage gas pipe 18, and a liquid tube 19.

[0008] Moreover, another heat-source side unit 7b which built in capacity good transformation compressor 8b, the four way valve 23 and hydrothermal exchanger 9b to which adjustable [of the operation frequency] is carried out, and vapor-liquid-separation machine 10b in the head-lining space 22 of Building 15c and 14 15d, the first floor of for example, rooms. Another use side units 1c and 1d which built in the use side heat exchangers 2c and 2d, Blowers 3c and 3d, and the reducing valves 4c and 4d, such as an electric expansion valve, respectively are installed. Another heat pump type refrigerator 21b is constituted like illustration by connecting for the refrigerant piping 26 between [of two] units which consists of a gas pipe 24 and a liquid tube 25.

[0009] 27 is the heat source which built in the capacity good transformation compressor 28 with which adjustable [of the operation frequency] is carried out, the air-cooled heat-source side heat exchanger 29, the use side heat exchanger 30 of a water cooling type, a four way valve 31, the vapor-liquid-separation machine 32, the reducing valves 33, such as an electric expansion valve, and a blower 34. It installs in the roof 35 of a building 14, and the circulating water circuit

38 is formed by connecting the use side heat exchanger 30 and the hydrothermal exchangers 9a and 9b with a circulating pump 36 for the water piping 50 through the temperature control cross valve 37 like illustration.

[0010] 39 and 40 are prepared in a Rooms [15a, 15b, 15c, and 15d] bridge wall, and it is prepared in the crown plates 42 and 43 of the first floor and the second floor of Rooms 15a, 15b, 15c, and 15d 41a, 41b, 41c, and 41d. It is opening for deriving Rooms 15a, 15b, and 15c and the air which introduced the indoor air in 15d into the use side units 1a, 1b, 1c, and 1d, was cooled at the time of air conditioning by use side heat exchanger 2a, 2b, and 2c and 2d, and was heated at the time of heating into Rooms 15a, 15b, and 15c and 15d.

[0011] When the conditioner of this invention is constituted like the above and it air-conditions Rooms 15a and 15b By closing change-over valves 13, 6a, and 6b, while opening change-over valves 12, 5a, and 5b, and changing the auxiliary reducing valve 11 into an open condition It circulates with 9a-auxiliary reducing-valve 11-liquid tube 19-main reducing-valve 4a, 4b-use side heat exchanger 2a, 2b-change-over valve 5a, and 5b-low voltage gas pipe 18-suction pipe 45-vapor-liquid-separation machine 10a-compressor 8a. the refrigerant breathed out from capacity good transformation compressor 8a -- a discharge-tube 44-change-over valve 12-heat-source side heat exchanger -- Hydrothermal exchanger 9a acts as a condenser, use side heat exchanger 2a and 2b act as an evaporator, respectively, and Rooms 15a and 15b are air-conditioned.

[0012] On the other hand, when air-conditioning Rooms 15c and 15d By setting a four way valve 23 as a continuous-line condition, the refrigerant breathed out from capacity good transformation compressor 8b is a four way valve 23. - It circulates with heat-source side heat exchanger 9b-liquid tube 25-reducing-valve 4c, 4d-use side heat exchanger 2c, and 2d-gas pipe 24-four-way-valve 23-vapor-liquid-separation machine 10b-compressor 8b. Hydrothermal exchanger 9b acts as a condenser, the use side heat exchangers 2c and 2d act as an evaporator, respectively, and Rooms 15c and 15d are air-conditioned.

[0013] Thus, while the heat pump type refrigerators 21a and 21b are all carrying out air conditioning operation, heat souce 27 is set as a continuous-line condition, and the four way valve 31 is carrying out the cooling down. It circulates with the heat exchanger 30-four-way-valve 31-vapor-liquid-separation machine 32-compressor 28 a 31-heat-sources side heat exchanger 29-reducing-valve 33-use side. the refrigerant breathed out from the capacity good transformation compressor 28 -- a four way valve -- the heat-source side heat exchanger 29 as a condenser When the use side heat exchanger 30 acts as an evaporator, respectively, circulating water (heat source water) cooled by the use side heat exchanger 30 flows at the hydrothermal exchangers 9a and 9b with a circulating pump 36, and these hydrothermal exchangers 9a and 9b are cooled. Namely, air conditioning operation of each use side units 1a, 1b, 1c, and 1d is carried out by supplying the air conditioning heat source drawn from the open air by heat souce 27 through the circulating water circuit 38 to each heat-source side units 7a and 7b. Since the die length of the refrigerant piping 20 and 26 between units of the heat pump type refrigerators 21a and 21b is short, while cooling capacity is demonstrated enough, oil is promptly collected from use side heat exchanger 2a, 2b, and 2c and 2d to Compressors 8a and 8b, respectively.

[0014] Moreover, by opening change-over valves 13, 6a, and 6b, while closing change-over valves 12, 5a, and 5b, and changing the auxiliary reducing valve 11 into an open condition, when heating Rooms 15a and 15b It circulates through the refrigerant breathed out from capacity good transformation compressor 8a with heat exchanger 9a-change-over valve 13-suction pipe 45-vapor-liquid-separation machine 10a-compressor 8a a discharge-tube 44-change-over valve 6a, 6b-use side heat exchanger 2a, 2b-main reducing-valve 4a, and 4b-liquid tube 19-auxiliary reducing-valve 11-heat-source side. Hydrothermal exchanger 9a acts as an evaporator, use side heat exchanger 2a and 2b act as a condenser, respectively, and Rooms 15a and 15b are heated.

[0015] On the other hand, when heating Rooms 15c and 15d It circulates through the refrigerant breathed out from capacity good transformation compressor 8b by setting a four way valve 23 as a broken-line condition with four-way-valve 23-gas pipe 24-use side heat exchanger 2c, 2d-reducing-valve 4c, and 4d-liquid tube 25-hydrothermal exchanger 9b-four-way-valve 23-vapor-

liquid-separation machine 10b-compressor 8b. Hydrothermal exchanger 9b acts as an evaporator, the use side heat exchangers 2c and 2d act as a condenser, respectively, and Rooms 15c and 15d are heated.

[0016] Thus, while the heat pump type refrigerators 21a and 21b are carrying out heating operation at all, a four way valve 31 switches to a broken-line condition, and is carrying out heating operation of the heat source 27. It circulates with the heat exchanger 29-four-way-valve 31-vapor-liquid-separation machine 32-compressor 28 a 31-use side heat exchanger 30-reducing-valve 33-heat-source side. the refrigerant breathed out from the capacity good transformation compressor 28 -- a four way valve -- the heat-source side heat exchanger 29 as an evaporator When the use side heat exchanger 30 acts as a condenser, respectively, circulating water (heat source water) heated by the use side heat exchanger 30 flows at the hydrothermal exchangers 9a and 9b with a circulating pump 36, and these hydrothermal exchangers 9a and 9b are heated. Namely, heating operation of each use side units 1a, 1b, 1c, and 1d is carried out by supplying the heating heat source drawn from the open air by heat source 27 through the circulating water circuit 38 to each heat-source side units 7a and 7b. Since the die length of the refrigerant piping 20 and 26 between units of the heat pump type refrigerators 21a and 21b is short, while heating capacity is demonstrated enough, oil is promptly collected from use side heat exchanger 2a, 2b, and 2c and 2d to Compressors 8a and 8b, respectively.

[0017] Moreover, when air conditioning operation is carried out at coincidence by the heating capacity whose heat pump type refrigerator 21b of another side it is the cooling capacity one heat pump type refrigerator 21a of whose is 10 horsepower, and is 6 horsepower, cooling capacity has exceeded 4 horsepower and the cooling down of the heat source 27 is carried out. At the time of this operation, within limits to which adjustable [of the capacity] is carried out for capacity good transformation compressor 8 of one heat pump type refrigerator 21a a between 6 horsepower and 10 horsepower according to fluctuation of a cooling load, since cooling capacity has exceeded heating capacity, heat source 27 continues the cooling down, and heat source 27 does not switch from a cooling down to heating operation frequently by fluctuation of a cooling load etc. The flow rate which flows the bypass way 47 is adjusted by the capacity good transformation compressor 28 of heat source 27 detecting the circulating water (heat source water) temperature by the sensor 46 while capacity decreases and efficient operation is performed, and controlling the opening of the temperature control cross valve 37 as it combines and the difference of cooling capacity and heating capacity becomes small.

[0018] And if the amount of endoergic by hydrothermal exchanger 9 of heat pump type refrigerator 21b in which cooling capacity is carrying out heating operation with heat release by hydrothermal exchanger 9 of heat pump type refrigerator 21a which is falling further and is carrying out air conditioning operation a b balances, since a heat source will be provided by transfer of mutual heat, while heat source 27 suspends operation, the temperature control cross valve 37 switches and it comes to flow the bypass way 47 altogether.

[0019] Conversely, as for switching from a cooling down to heating operation, heating capacity does not need to say [upper ***** and heat source 27] cooling capacity. namely, one heat pump type refrigerator 21a or heat-source side unit 7a -- air conditioning (heating) operation -- heat pump type refrigerator 21b of another side, or heat-source side unit 7b -- heating (air conditioning) operation -- as -- when performing heating-and-cooling parallel running between heat pump type refrigerators or in a heat-source side unit, it is the capacity of the difference of an air conditioning (heating) load and a heating (air conditioning) load, and if heat source 27 is made to operate, it *****s. As a result, exhaust heat recovery is performed through circulating water (heat source water).

[0020] Moreover, when air-conditioning one room 15a by heat pump type refrigerator 21a and heating room 15b of another side By closing change-over valves 13, 6a, and 5b, while opening change-over valves 12, 5a, and 6b While some refrigerants breathed out from capacity good transformation compressor 8a branch from a discharge tube 44 and it flows to heat-source side heat exchanger 9a through a change-over valve 12, the remaining regurgitation refrigerants flow to use side heat exchanger 2b through high pressure gas tubing 17-change-over valve 6b. It is

condensate-ized by this use side heat exchanger 2b and heat-source side heat exchanger 9a. And after the refrigerant condensate-ized by these heat exchangers joins with a liquid tube 19 through the auxiliary reducing valve 11 and main reducing-valve 4b, it is decompressed by main reducing-valve 4a, and after it carries out evaporation evaporation by use side heat exchanger 2a, it is inhaled by compressor 8a through change-over valve 5a, the low voltage gas pipe 18, a suction pipe 45, and vapor-liquid-separation machine 10a. Thus, room 15b is heated by use side heat exchanger 2b of another side where room 15a is air-conditioned and while acting as an evaporator acts as a condenser by use side heat exchanger 2a. Use side heat exchanger 2b by closing the auxiliary reducing valve 11 at the time of this air conditioning parallel running, making it feel, opening main reducing-valve 4b and making it feel as a main condenser. Since heat recovery is carried out by use side heat exchanger 2a of another side where heat-source side heat exchanger 9a acts as an auxiliary condenser, and acts as a use side heat exchanger 2b and evaporator of one of these, capacity good transformation compressor 8a becomes feeble-minded force operation, and its operation effectiveness improves. In order that it may combine and the heat release by hydrothermal exchanger 9a may decrease, while heat pump type refrigerator 21b of another side is carrying out air conditioning operation, the capacity good transformation compressor 38 of heat source 27 serves as feeble-minded force operation, and cooling-down effectiveness improves.

[0021] Furthermore, if the cooling load of one room 15a and the space heating load of room 15b of another side match, change-over valves 5a and 6b will be opened (other change-over valves are closed), and the opening of two reducing valves 4a and 4b will be adjusted. The refrigerant breathed out from capacity adjustable compressor 8a flows to use side heat exchanger 2b through change-over valve 6b altogether, and after condensate-izing it, it flows to use side heat exchanger 2a through reducing valves 4b and 4a, and it is evaporative-gas-ized by this here. Air conditioning and room 15b of another side are heated for one room 15a by this operation. Therefore, since it *****s without making hydrothermal exchanger 9a act, exhaust heat recovery is performed through a refrigerant by the use side unit comrade.

[0022] It cannot be overemphasized that you may be a cooling tower for generating the boiler and cold water for not being based on a refrigerating cycle and generating warm water for example, as long as the above-mentioned heat source 27 sends the so-called heat source water into a hydrothermal exchanger. Furthermore, the installation of the heat-source side units 7a and 7b may be the machine tooth space of each story. refrigerator 21a in which heating-and-cooling parallel running is possible also about a refrigerator, and heating and cooling -- the combination of only the refrigerator of not only combination with refrigerator 21b which can only operate either but one of classes is sufficient.

[0023]

[Effect of the Invention] As stated above, the refrigerator with which this invention is installed in each story of a building, and the heat source installed in the roof of a building should be connected for water piping. Since high pressure gas tubing, the low voltage gas pipe, and the liquid tube tied the heat-source side unit which constitutes a refrigerator, and the use side unit. When exhaust heat recovery is performed through heat source water when performing heating-and-cooling parallel running between refrigerators (refrigerator unit), and, performing heating-and-cooling parallel running within a refrigerator on the other hand, exhaust heat recovery is performed through a refrigerant. Thus, heat recovery could be performed also at the time of which heating-and-cooling parallel running, and useless operation of it which is not was attained.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the refrigerant circuit Fig. showing the gestalt of operation of this invention.

[Description of Notations]

1a, 1b, 1c, 1d Use side unit
7a, 7b Heat-source side unit
8a, 8b Compressor
9a, 9b Hydrothermal exchanger
14 Building
17 High Pressure Gas Tubing
18 Low Voltage Gas Pipe
19 Liquid Tube
20 Refrigerant Piping
21a, 21b Refrigerator
27 Heat Souce
50 Water Piping

[Translation done.]

(19) 日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11) 特許出願公開番号

特開平8-261517

(43) 公開日 平成8年(1996)10月11日

(51) Int.Cl. ⁶	識別記号	序内整理番号	F I	技術表示箇所
F 24 F 5/00	101		F 24 F 5/00	101Z
F 25 B 1/00	397		F 25 B 1/00	397C
13/00			13/00	U

審査請求 有 請求項の数1 OL (全5頁)

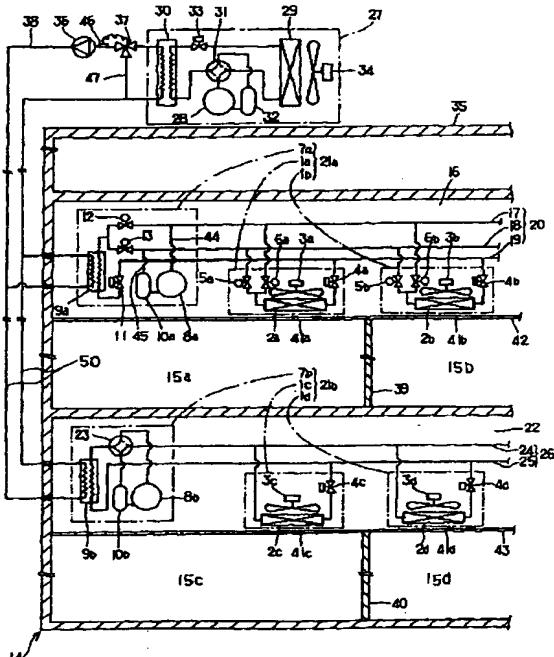
(21) 出願番号 特願平8-74733
(62) 分割の表示 特願平1-153283の分割
(22) 出願日 平成1年(1989)6月15日

(71) 出願人 000001889
三洋電機株式会社
大阪府守口市京阪本通2丁目5番5号
(72) 発明者 関上 邦衛
大阪府守口市京阪本通2丁目18番地 三洋
電機株式会社内
(74) 代理人 弁理士 岡田 敬

(54) 【発明の名称】 空気調和装置

(57) 【要約】

【課題】 室内の負荷に適した熱回収型のビル用の空気調和装置を提供することを目的としたものである。
【解決手段】 ビル14の屋上35に熱源水を生成する熱源機27を配置し、このビルの各階には前記熱源機27と水配管50でつながれる熱源側ユニット7a, 7b並びにこの熱源側ユニットから延びた冷媒配管20とつながれる複数台の利用側ユニット1a, 1b, 1c, 1dとからなる冷凍機21a, 21bを配置し、この熱源側ユニット7a, 7bには圧縮機8a, 8bと熱源水にて冷媒を熱交換させる水熱交換器9a, 9bとを内蔵させ、これら両機器につながれ且つ熱源側ユニットから延びる冷媒配管20を、高圧ガス管17と低圧ガス管18と液管19とから構成するようにしたものである。



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【特許請求の範囲】

【請求項1】ビルの屋上に熱源水を生成する熱源機を配置し、このビルの各階には前記熱源機と水配管でつながれる熱源側ユニット並びにこの熱源側ユニットから伸びた冷媒配管とつながれる複数台の利用側ユニットとかなる冷凍機を配置した空気調和装置において、前記熱源側ユニットには圧縮機と前記熱源水にて冷媒を熱交換させる水熱交換器とを内蔵させ、これら両機器につながれ且つ前記熱源側ユニットから伸びる冷媒配管を、高圧ガス管と低圧ガス管と液管とから構成したことを特徴とする空気調和装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、高層ビルの各階を冷暖房する空気調和装置に関する。

【0002】

【従来の技術】高層ビル等を冷暖房する空気調和装置として、例えば実公昭52-7082号公報で提示されているように圧縮機と熱源側熱交換器と利用側熱交換器とが一体に内蔵され各階に設置される一体型空気調和装置や、圧縮機と熱源側熱交換器を内蔵した熱源側ユニットをビルの屋上に、且つ利用側熱交換器を内蔵した利用側ユニットを各階の部屋に設置した分離型空気調和装置がある。

【0003】

【発明が解決しようとする課題】上記公報で提示の一体型空気調和装置では、ビルの各階より空気調和装置の一部が露出するため見栄えが悪いと共に、各空気調和装置の全てに圧縮機の騒音が漏出しないように防音手段を施さなければならなかった。又、上述の分離型空気調和装置では、熱源側ユニットと利用側ユニットとの高低差やこの両ユニット間の配管長により冷房能力が充分發揮されないと共に冷房時に利用側ユニットから熱源側ユニットへのオイル戻りが悪く、圧縮機が破損する虞れがあった。

【0004】本発明はかかる課題を解決すると共に、高層ビルの各階（フロア）において、一方を冷房、他方を暖房というように室内の負荷に適した熱回収型のビル用の空気調和装置を提供することを目的としたものである。

【0005】

【課題を解決するための手段】この目的を達成するため、本発明は、ビルの屋上に熱源水を生成する熱源機を配置し、このビルの各階には前記熱源機と水配管でつながれる熱源側ユニット並びにこの熱源側ユニットから伸びた冷媒配管とつながれる複数台の利用側ユニットとかなる冷凍機を配置し、この熱源側ユニットには圧縮機と熱源水にて冷媒を熱交換させる水熱交換器とを内蔵させ、これら両機器につながれ且つ熱源側ユニットから伸びる冷媒配管を、高圧ガス管と低圧ガス管と液管とから

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構成するようにしたものである。

【0006】このように構成したので、一つの熱源側ユニットに接続された利用側ユニット間すなわちこれらユニットで構成される冷凍機内で冷暖房同時運転を行う場合は、冷媒を介して排熱回収が行われる。一方、異なる冷凍機間で冷暖房同時運転を行う場合は、熱源水を介して排熱回収が行われる。

【0007】

【発明の実施の形態】図1に基づいて説明すると、1a、1bは夫々利用側熱交換器2a、2bと送風機3a、3bと電動膨張弁等の主減圧弁4a、4bと切換弁5a、6a、5b、6bとを内蔵した複数台の利用側ユニット、7aは運転周波数が可変される能力可変型圧縮機8aと水冷式の水熱交換器9aと気液分離器10aと電動膨張弁等の補助減圧弁11と切換弁12、13とを内蔵した熱源側ユニットで、熱源側ユニット7aと利用側ユニット1a、1bとを建物（ビル）14の例えば2階の部屋15a、15bの天井空間16内に設置して図示の如く高圧ガス管17と低圧ガス管18と液管19とからなる3本のユニット間冷媒配管20で接続することによりヒートポンプ式冷凍機21aが構成されている。

【0008】又、建物14の例えば1階の部屋15c、15dの天井空間22内には運転周波数が可変される能力可変型圧縮機8bと四方弁23と水熱交換器9bと気液分離器10bとを内蔵した別の熱源側ユニット7bと、利用側熱交換器2c、2dと送風機3c、3dと電動膨張弁等の減圧弁4c、4dとを夫々内蔵した別の利用側ユニット1c、1dとを設置して図示の如くガス管24と液管25とからなる2本のユニット間冷媒配管26で接続することにより別のヒートポンプ式冷凍機21bが構成されている。

【0009】27は運転周波数が可変される能力可変型圧縮機28と空冷式の熱源側熱交換器29と水冷式の利用側熱交換器30と四方弁31と気液分離器32と電動膨張弁等の減圧弁33と送風機34とを内蔵した熱源機で、建物14の屋上35に設置して、利用側熱交換器30と水熱交換器9a、9bとを図示の如く循環ポンプ36と温調三方弁37を介して水配管50で接続することにより循環水回路38が形成されている。

【0010】39、40は部屋15a、15b、15c、15dの仕切壁、41a、41b、41c、41dは1階及び2階の部屋15a、15b、15c、15dの天井板42、43に設けられ、部屋15a、15b、15c、15d内に室内空気を利用側ユニット1a、1b、1c、1dに導入し利用側熱交換器2a、2b、2c、2dで冷房時に冷却され暖房時に加熱された空気を部屋15a、15b、15c、15d内へ導出するための開口である。

【0011】本発明の空気調和装置は以上の如く構成されており、部屋15a、15bを冷房する場合は、切換

弁12, 5a, 5bを開くと共に切換弁13, 6a, 6bを閉じ、且つ補助減圧弁11を開放状態により、能力可変型圧縮機8aから吐出された冷媒は吐出管44-切換弁12-熱源側熱交換器9a-補助減圧弁11-液管19-主減圧弁4a, 4b-利用側熱交換器2a, 2b-切換弁5a, 5b-低圧ガス管18-吸込管45-気液分離器10a-圧縮機8aと循環し、水熱交換器9aが蒸発器として、利用側熱交換器2a, 2bが凝縮器として夫々作用して部屋15a, 15bが冷房される。

【0012】一方、部屋15c, 15dを冷房する場合は、四方弁23を実線状態に設定することにより、能力可変型圧縮機8bから吐出された冷媒は四方弁23-熱源側熱交換器9b-液管25-減圧弁4c, 4d-利用側熱交換器2c, 2d-ガス管24-四方弁23-気液分離器10b-圧縮機8bと循環し、水熱交換器9bが凝縮器として、利用側熱交換器2c, 2dが蒸発器として夫々作用して部屋15c, 15dが冷房される。

【0013】このようにヒートポンプ式冷凍機21a, 21bが何れも冷房運転している時は熱源機27は四方弁31が実線状態に設定されて冷却運転しており、能力可変型圧縮機28から吐出された冷媒は四方弁31-熱源側熱交換器29-減圧弁33-利用側熱交換器30-四方弁31-気液分離器32-圧縮機28と循環し、熱源側熱交換器29が凝縮器として、利用側熱交換器30が蒸発器として夫々作用することにより、利用側熱交換器30で冷却された循環水(熱源水)が循環ポンプ36により水熱交換器9a, 9bに流れこれに水熱交換器9a, 9bが冷却されている。即ち、各利用側ユニット1a, 1b, 1c, 1dは外気から熱源機27で汲みとった冷房熱源が各熱源側ユニット7a, 7bに循環水回路38を介して供給されることにより冷房運転されており、ヒートポンプ式冷凍機21a, 21bのユニット間冷媒配管20, 26の長さが短い為、冷房能力が充分発揮されると共に利用側熱交換器2a, 2b, 2c, 2dから圧縮機8a, 8bへ夫々オイルが速やかに回収される。

【0014】又、部屋15a, 15bを暖房する場合は、切換弁12, 5a, 5bを閉じると共に切換弁13, 6a, 6bを開き、且つ補助減圧弁11を開放状態により、能力可変型圧縮機8aから吐出された冷媒は吐出管44-切換弁6a, 6b-利用側熱交換器2a, 2b-主減圧弁4a, 4b-液管19-補助減圧弁11-熱源側熱交換器9a-切換弁13-吸込管45-気液分離器10a-圧縮機8aと循環し、水熱交換器9aが蒸発器として、利用側熱交換器2a, 2bが凝縮器として夫々作用して部屋15a, 15bが暖房される。

【0015】一方、部屋15c, 15dを暖房する場合は、四方弁23を破線状態に設定することにより、能力

可変型圧縮機8bから吐出された冷媒は四方弁23-ガス管24-利用側熱交換器2c, 2d-減圧弁4c, 4d-液管25-水熱交換器9b-四方弁23-気液分離器10b-圧縮機8bと循環し、水熱交換器9bが蒸発器として、利用側熱交換器2c, 2dが凝縮器として夫々作用して部屋15c, 15dが暖房される。

【0016】このようにヒートポンプ式冷凍機21a, 21bが何れも暖房運転している時は熱源機27は四方弁31が破線状態に切換わって加熱運転しており、能力可変型圧縮機28から吐出された冷媒は四方弁31-利用側熱交換器30-減圧弁33-熱源側熱交換器29-四方弁31-気液分離器32-圧縮機28と循環し、熱源側熱交換器29が蒸発器として、利用側熱交換器30が凝縮器として夫々作用することにより、利用側熱交換器30で加熱された循環水(熱源水)が循環ポンプ36により水熱交換器9a, 9bに流れこれに水熱交換器9a, 9bが加熱されている。即ち、各利用側ユニット1a, 1b, 1c, 1dは外気から熱源機27で汲みとった暖房熱源が各熱源側ユニット7a, 7bに循環水回路38を介して供給されることにより暖房運転されており、ヒートポンプ式冷凍機21a, 21bのユニット間冷媒配管20, 26の長さが短い為、暖房能力が充分発揮されると共に利用側熱交換器2a, 2b, 2c, 2dから圧縮機8a, 8bへ夫々オイルが速やかに回収される。

【0017】又、一方のヒートポンプ式冷凍機21aが例えば10馬力の冷房能力で、且つ他方のヒートポンプ式冷凍機21bが例えば6馬力の暖房能力で同時に冷暖房運転されている時は冷房能力が4馬力上回っており熱源機27は冷却運転されている。かかる運転時、冷房負荷の変動に応じて一方のヒートポンプ式冷凍機21aの能力可変型圧縮機8aが6馬力から10馬力の間で能力が可変される範囲内では冷房能力が暖房能力を上回っているため熱源機27は冷却運転を続行しており、熱源機27が冷房負荷等の変動により頻繁に冷却運転から加熱運転に切り換わることはない。併せて、冷房能力と暖房能力との差が小さくなるに従って熱源機27の能力可変型圧縮機28は能力が減少され、効率の良い運転が行われると共に、循環水(熱源水)温度をセンサ46で検出して温調三方弁37の開度が制御されることによりバイパス路47を流れる流量が調節される。

【0018】そして、冷房能力が更に低下し、冷房運転しているヒートポンプ式冷凍機21aの水熱交換器9aによる放熱量と暖房運転しているヒートポンプ式冷凍機21bの水熱交換器9bによる吸熱量とがバランスすると互いの熱の授受により熱源がまかなわれる為、熱源機27が運転を停止すると共に温調三方弁37が切り換わってバイパス路47を全て流れるようになる。

【0019】逆に暖房能力が冷房能力を上回ると熱源機27が冷却運転から加熱運転に切り換わることは言う

迄もない。すなわち、一方のヒートポンプ式冷凍機21aもしくは熱源側ユニット7aが冷房(暖房)運転を、他方のヒートポンプ式冷凍機21bもしくは熱源側ユニット7bが暖房(冷房)運転をというように、ヒートポンプ式冷凍機間もしくは熱源側ユニットで冷暖同時運転を行う場合は、冷房(暖房)負荷と暖房(冷房)負荷の差分の能力で、熱源機27を運転させれば事足りる。結果として、循環水(熱源水)を介して排熱回収が行われている。

【0020】又、ヒートポンプ式冷凍機21aで一方の部屋15aを冷房し、他方の部屋15bを暖房する場合は、切換弁12、5a、6bを開くと共に切換弁13、6a、5bを閉じることにより、能力可変型圧縮機8aから吐出された冷媒の一部が吐出管44より分岐して切換弁12を経て熱源側熱交換器9aに流れると共に残りの吐出冷媒が高圧ガス管17-切換弁6bを経て利用側熱交換器2bに流れ、この利用側熱交換器2bと熱源側熱交換器9aとで凝縮液化される。そして、これら熱交換器で凝縮液化された冷媒は補助減圧弁11、主減圧弁4bを経て液管19で合流した後、主減圧弁4aで減圧され、利用側熱交換器2aで蒸発気化した後、切換弁5a、低圧ガス管18、吸込管45、気液分離器10aを経て圧縮機8aに吸入される。このように蒸発器として作用する一方の利用側熱交換器2aで部屋15aが冷房され、凝縮器として作用する他方の利用側熱交換器2bで部屋15bが暖房される。かかる冷暖房同時運転時ににおいて、補助減圧弁11を閉じ気味にし、主減圧弁4bを開き気味にすることにより利用側熱交換器2bが主凝縮器として、熱源側熱交換器9aが補助凝縮器として作用し、この一方の利用側熱交換器2b及び蒸発器として作用する他方の利用側熱交換器2aで熱回収されるため、能力可変型圧縮機8aは低能力運転となり運転効率が向上する。併せて、水熱交換器9aによる放熱量が減少するため、他方のヒートポンプ式冷凍機21bが冷房運転している時は熱源機27の能力可変型圧縮機38が低能力運転となり冷却運転効率が向上する。

【0021】更に、一方の部屋15aの冷房負荷と他方の部屋15bの暖房負荷が釣り合うと、切換弁5a、6bを開放(他の切換弁は閉鎖)し、2つの減圧弁4a、4bの開度を調整する。これによって、能力可変圧縮機8aから吐出された冷媒は、全て切換弁6bを介して利用側熱交換器2bに流れ、ここで、凝縮液化した後減圧

弁4b、4aを介して利用側熱交換器2aに流れ、ここで蒸発ガス化される。この作用で一方の部屋15aが冷房、他方の部屋15bが暖房される。従って、水熱交換器9aは作用させずに事足りるので、利用側ユニット同志で冷媒を介して排熱回収が行われる。

【0022】上記熱源機27は、いわゆる熱源水を水熱交換器へ送り込むものであれば、冷凍サイクルによるものなくとも良く、例えば温水を生成するためのボイラや冷水を生成するためのクーリングタワーであっても良いことは言うまでもない。更に熱源側ユニット7a、7bの設置場所は各階の機械スペースであっても良い。冷凍機についても、冷暖同時運転が可能な冷凍機21aと冷暖どちらか一方の運転のみ可能な冷凍機21bとの組み合わせに限らず、どちらか一方の種類の冷凍機のみの組み合わせでも良い。

【0023】

【発明の効果】以上述べたように、本発明は、ビルの各階に設置される冷凍機とビルの屋上に設置される熱源機とは水配管でつながれ、冷凍機を構成する熱源側ユニットと利用側ユニットとは高圧ガス管と低圧ガス管と液管とでつなぐようにしたので、冷凍機間(冷凍機単位)で冷暖同時運転を行う場合は熱源水を介して排熱回収が行われ、一方冷凍機内で冷暖同時運転を行う場合は冷媒を介して排熱回収が行われる。このようにいずれの冷暖同時運転時も熱回収を行うことができ、無駄のない運転が可能となった。

【図面の簡単な説明】

【図1】本発明の実施の形態を示す冷媒回路図である。

【符号の説明】

30	1a, 1b, 1c, 1d	利用側ユニット
	7a, 7b	熱源側ユニット
	8a, 8b	圧縮機
	9a, 9b	水熱交換器
	14	ビル
	17	高圧ガス管
	18	低圧ガス管
	19	液管
	20	冷媒配管
40	21a, 21b	冷凍機
	27	熱源機
	50	水配管

【図1】

